The Phase 2 upgrade of CMS Drift Tube Detector for High Luminosity LHC
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Overview

Drift Tubes (DT)

CMS Muon System

Challenges at high luminosity LHC
- Increase in CMS maximal Level-1 Trigger (L1T) rate
- Trigger latency from 3.6 μs to 12.5 μs
- Chambers/electronics to be operated at high radiation background

DT Upgrade motivation
- Higher acceptable L1 trigger rate
- Reduced HW complexity and more granularity
- More convenient maintenance

Phase 2 DT Slice Test

Four DT chambers in Sec 12 of wheel YB+2 have been equipped with Phase 2 On Boards DT electronics (OBDT): DT Slice Test

OBDT prototype v 1.0

Phase 2 DT Slice Test Performance

Relative efficiency to detect a hit with Phase 1 readout, when a hit is recorded by the Phase 2 readout (left) and vice versa (right).
- Very good agreement between the Phase 1 and Phase 2 performance is observed

Crossing time (left) and number of associated hits (right) of segments reconstructed using Phase 1 (black) and Phase 2 (red) digis.
- Remarkable agreement is observed between Phase 1 and Phase 2

Difference between trigger primitive’s (TP) time and the offline reconstructed segment time, for Phase 2 (in blue) and for legacy trigger (in red)

Due to the better time granularity, improved time resolution in Phase 2 for the cosmic muons, as the lower fraction of triggers at the wrong BX (12.5 ns away from the time the muon crossed the chamber)

Hardware developments of DT Phase 2 Upgrade

ϕ-OBDT v2

Pre-production of few ϕ-OBDT v2 (new safety features & revised clock distribution) prototypes for DT ϕ superlayers
- One ϕ-OBDT v2 prototype already installed in one DT chamber, commissioning ongoing

On mechanical support

On DT Chamber

OBDT Theta

5 OBDT theta prototypes assembled with the lpgBTs are produced and validation ongoing in the lab
- Work also ongoing on the mechanical integration and routing of the fibres

Summary

- The Phase 2 DT Slice Test successfully installed & operated over LHC LS2
- The performance is in line with the Phase 1 system already exploiting the DT cell resolution
- Aiming to operate the present DT Phase 2 Slice Test during Run 3 in parallel to the legacy system
- Further developments of OBDT prototype versions are ongoing in parallel